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ABSTRACT

Although the Federal government is presently the major sponsor of research and development (R&D) in the United States, in recent years the level of funding once obligated to basic research has declined. Academic institutions have increasingly relied on other sources of support for R&D because of a decline in the growth rate of federal, state, and local funds. A chart on 1976 federal R&D obligation by function indicates that although colleges and universities received 12 percent of the total federal R&D obligations, functionally R&D dollars are not translated to schools. Another chart on federal obligations by agency in 1975 shows that the top institutions receive more funds from a variety of agency-sources while other institutions receive funding almost exclusively from the Federal government. Federal R&D dollars appear to be distributed in an equitable manner to different types of schools. A large portion of R&D dollars in the United States is spent on applied research. There are a number of questions which should be addressed concerning the mechanism of allocations as related to federal/state problems of equity, and the problems of state and federal coordination as related to the ability of higher educational institutions to control their R&D programs. (SW)

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Changes in Federal R&D Funding Patterns to Higher Education: Emerging Factors that Challenge State and Institutional Intervention

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by

Patricia Martin Peters

Federal and State Interest in Higher Education,
Educational Administration, 852

Dr. Ken Hansen

May, 1978

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"Since the fruits of research benefit the entire country, it seems appropriate in principle that the federal government assume this share of the cost."[1]

The federal government is presently assuming the major sponsorship of research and development in this country. Yet, in recent years, the level of funding once obligated to basic research has declined. The major research university presidents have viewed this slow erosion of funding as a declining commitment to basic research in higher education; as such, they have tended to view the decline as a sign of less quality research, fewer academic jobs, and a lowered status for the major research universities; they have not tended to view the decline as a sign of less intervention on the part of federal government. Needless to say, they have tied the health of this country to the excellence of the research effort in higher education.

Other universities and colleges are viewing the trend- to receive less rather than more, or even sustained levels of funding for research and development- with the same dissatisfaction. This dissatisfaction, which may lead to intervention on the part of states and institutions , began as several major concerns.

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[1]Research Universities and the National Interest: A Report from Fifteen University Presidents (New York: Ford Foundation, 1978) p. 39. Hereafter, this report is cited as Research Universities and the National Interest.

Much dissatisfaction has been generated over the fact that while the federal government is the major sponsor of R&D in higher education, academic institutions have relied more and more on other sources of support for R&D because of a decline in the growth rate of federal, state, and local funds. "In 1975, universities and colleges reported that increases in R&D funding from industry and private foundations exceeded the rates of expansion from all governmental sources of R&D support."[2]

Some dissatisfaction has emanated from the difficulities involved in assessing the total amount of R&D dollars spent in higher education. For example, for educational R&D in 1975, the NSF estimated that approximately $158 million had been spent; the Office of Management and Budget (OMB) estimated that$430 million had been spent; another source estimated that around $576 million had been spent; the National Center for Education Statistics used all of these estimates to suggest that a range of $158-$520 million was a more realistic estimate of what had been spent.[3]

This difficulty arose from the fact that it is difficult to assess the total amount of R&D dollars spent in higher education because R&D monies vary by function, agency, and level of aggregration, etc.

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[2]National Science Foundation. Expenditures for Scientific Activities at Universities and Colleges: Fiscal Year, 1975, (Washington: United States Government Printing Office) p. 3. Taken from National Patterns of R&D Resources 1953-1976 (NSF 76-310).

[3]National Institute of Education, Databook 1976, pp. 15-16.

From the chart on the "Federal R&D Obligations by Function, Fiscal Year 1976," one can see that the majority of R&D funds were available for national defense, space, health, energy, and science and technology. The energy, environmental, and agricultural priorities of 1978 are not far removed from the trend. From the chart, it is difficult to assess how many R&D dollars reached universities and colleges (and university-administered Federally Funded Research Development Centers) across specific functions. Although colleges and universities received 12 percent of the total federal R&D obligation to all sectors of the economy in 1976, the problem remains that functionally R&D dollars are not translated to colleges and universities.

FEDERAL R&D OBLIGATION by FUNCTION, FISCAL YEAR 1976

(DOLLARS IN MILLIONS)

TOTAL FUNCTIONS	$21,651.9*	
NATIONAL DEFENSE	11,358.1	
SPACE	2,897.4	
HEALTH	1,904.0	
ENERGY	1,276.8	(6,081.4 in 1978 Public Law 95-238)
SCIENCE & TECHNOLOGY	860.4	
NATURAL RESOURCES	825.4	
TRANSPORTATION & COMMUNICATION	711.9	
EDUCATION	318.2	
REMAINING FUNCTIONS: SOCIAL, ECONOMIC, HOUSING, CRIME PREVENTION,ETC.	1,498.0	

*Colleges and universities received 12% of total federal R&D obligation to all sectors of the economy: Total U.S. R&D for 1976, $38 billion.

SOURCES: NSF data in article by Orstein, Allan C., "The Federal Role in Education R&D," The Clearinghouse, (January, 1978), 230-233.

Public Law 95-238

NIE, Databook, 1976.

R&D dollars can also be received by agency. A look at the chart entitled, "Obligations of Selected Federal Agencies to Colleges and Universities, by Agency," 1975, shows that the top institutions receive a more 'diverse R&D package'. This term is coined because it seems that such institutions received more funds from a variety of agency-sources. Institutions not in the top or middle sector received almost exclusively funding from Health, Education, and Welfare, HEW. The chart is used to convey this without presenting all the 2,517 institutions included in the National Science Foundation information. One does have to assume that a college or university not reveiving any R&D funding from a particular agency is also not receiving any R&D funds from that agency. Although the chart includes a number of selected agencies, it should be noted that all the major sources of funding do seem to be on the list. The tentative conclusion or finding seems to have some basis.

INSTITUTION[1]

OBLIGATIONS OF SELECTED FEDERAL AGENCIES TO UNIVERSITIES AND COLLEGES, BY AGENCY, FY 1975

	HUD, LABOR, NRC	USDA	COM	DOD	ERDA	HEW	INT	NASA	NSF	DOT
U of Wash-Madison	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Mass I. of Tech.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
U of Neb.-Lincoln	yes	yes	no	yes	yes	yes	yes	yes	yes	no
U of Pacific	no	no	no	no	no	yes	no	no	yes*	no
Jr. Col Dis Metro KC SYS	no	no	no	no	no	yes	no	no	no	no

* $4,000

[1] RANK----------1 U of Wash-Madison

2 Mass I. of Tech.

52 U of Neb. SYS (estimate)

2502 Jr. Col Dis Metro KC SYS

Rank based on 2,517 institutions ranked in descending order of total amount received.

SOURCE: YES-NO MODIFICATION BY THE AUTHOR OF THIS PAPER BASED ON ACTUAL AMOUNTS FROM NSF.

From the chart, "Percent of Total R&D Expenditures Financed by Federal Funds," 1972-1975, it seems that the R&D dollars are distributed in an equitable manner; the top 60 institutions, the next 140 institutions, and all other institutions seem to indicate percentage categories with small variances.

Using this chart together with the chart, "Obligations of Selected Federal Agencies to Colleges and Universities," one might conclude as did Halstead that federal R&D dollars in large measure support or subsidize talent or excellence. Halstead suggests that this occurs for the following reasons:

> (1)the buyer's demand for research excellence-a relatively rare commodity; (2)the large proportion of research funds alloted to the natural sciences and engineering: and (3) the fact that only a few institutions can afford the unique and costly equipment required for the research.[4]

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[4]D. Kent Halstead, Statewide Planning in Higher Education (Washington: United States Printing Office), p. 296.

INSTITUTIONS RANKED BY TOTAL R&D EXPENDITURES (1975)		PERCENT OF TOTAL R&D EXPENDITURES FINANCED BY FEDERAL FUNDS: FISCAL YEARS 1972-1975[1]			
		1975	1974	1973	1972
1	U of Wisconsin-Madison	50.5	54.9	54.4	52.7
2	Mass Institute of Tech.	82.2	81.1	89.8	89.8
57	U of Nebraska-Lincoln*				
133	U of Nebraska Med C at Omaha*	63.5	72.2	80.5	80.5
191	Loyola University	87.4	88.2	81.8	81.6
	U of Nebraska-Omaha*				
First 60 Institutions		68.3	68.5	70.7	69.9
Next 140 Institutions		65.4	65.3	66.8	66.4
All Other Institutions		62.3	63.4	62.8	64.7

*separate entries may not be meaniful for the total U of Nebraska System-campuses, institute, medical center, etc.

[1] Calculations done by the author of this paper based on NSF data for "Total and Federally Financed Research and Development Expenditures, by Institution: FY 1972-1975.

Part of the problems of R&D funding is related to the problems R&D often cited. For example, congressional members have not always been persuaded that research has significantly helped to alleviate or to solve the visible and contemporary problems facing Americans today. "Democrats and Republicans contended that basic, or what they called esoteric, research would simply open up more and more uncertain options instead of getting down to practical applications.....the lawmakers demanded a list in what one called cow pasture language telling what the taxpayer would get for the energy research funds."[5] In any event, congress seems to be more willing to support the development, dissemination, demonstration, and evaluation aspects of research.

This emerging factor must be related to the fact that a large portion of R&D in the United States is spent on applied research even though this is not the case in the funding situations involving universities and colleges. In fact, research funds are on the decline while R&D funds for applied research tends to be on the increase. Inthe 22 university-administered FFRDC's in 1975, the applied research surpasses R&D outlays for both basic research and development.[6]

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[5]Anne G. Roark, "Basic Research the Key to Solving Energy Crisis, University Scientists Say," The Chronicle of Higher Education, (May 1, 1978), p. 7.

[6]National Science Foundation, Expenditures for Scientific Activities at Universities and Colleges: Fiscal Year, 1975, (Washington: United States Government Printing Office), p.5.

"During the last 5 years, however, universities and colleges increasingly attributed more of their R&D to applied research..... since 1964 federally financed funds accounted for about three-fifths of academic applied research and in 1975 totaled $516 million."[7]

Fifteen university presidents from a pretigious set of research universities set forth their dismay with this emerging factor toward applied research in their report, The Research University and the National Interest. They suggested that too may targeted funds are awarded for problem-oriented, "short-term" priorities when in fact the basic research on which they are founded is sorely lacking. While they do not deny the use of funds for today's priorities in the areas of energy, agriculture, environment, and social problems, they do view with alarm the seemingly slow erosion of R&D funding to the major research universities and colleges alike.

The federal government has responded to some of these concerns. For example, Secretary of HEW, Joseph Califano, has recently proposed the development of a long-range blue print for support of basic health research.[8] The plan would also set priorities for the allocation of government health research dollars. Additional R&D dollars may be forthcoming to the humanities and the social sciences to counter the complaint by university and college officials that most R&D dollars are for science/technology.

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[7]Ibid.

[8]Associated Press Dispatch, Omaha World-Herald, April 30, 1978, Sunday Edition.

"In increasing measure the notion of a partnership for common basic *purposes* has been replaced, in many parts of government by the concept of a mere purchase of services."[9] It is not surprising, for example to find educational R&D being referred to now as "knowledge production and utilization". This does seem consistent with the trend or emerging factor to apply the commodity concepts of the market-place to research and development.

The Carter administration, however, has proposed that the intent of the cabinet-level Department of Education is to bring government into full partnership with state governments and universities in funding. However, none has suggested that the administration is using the argument that the Department of Education will also increase coordination of R&D funding to higher education; with R&D funds coming from so many federal agencies, it is not likely. It does seem to be a move in that direction in the future.

The emergence of factors to reduce R&D funds to higher education on the part of the federal government is not reflected in obligations for basic research in 1977-1978. However, "the actual disbursement of funds lags considerably behind authorizations so that 1977 federal support of basic research in colleges and universities has not increased in constant dollars."[10]

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[9] Research Universities and the National Interest, p. 14.

[10] Ibid., p. 40.

Institutions of higher education have sought other sources of funding for R&D to offset the reduction in federal R&D funding. Loyola University, for example, was able to increase its research and program funding from outside sources 12 percent and the expectation is that it will increase again. According to Reverend Matthew E. Creighton, Director of Research Services at Loyola University of Chicago, "Research is still an appropriate area to generate support for universities."[11] Some universities and colleges are thus countering the loss of federal funds and the resultant slowdown in the support of R&D as basic research by increasing their efforts to get additional traditional sources of funding or seeking new sources of support.

With industry becoming an increasing sponsor of R&D in higher education, another issue/factor has emerged in the minds of some. "If both private and public funds are paying for research, there is at least an appearance of conflicting interest....the issue relates to federally funded research on nearly any subject."[12] This may mean that the advent of increased regulations (coordination) regarding the dual use of consultants in higher education may not be far away.

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[11] Reverend Matthew E. Creighton named to succeed Reverend Joseph J. Labaj as Creighton University President July 1, 1978. Presently, Director of Loyola University of Chicago, from April 1978 (no date), Omaha World-Herald.

[12] "Changing Attitude on Consulting?," Sunday Omaha World-Herald. April 2, 1978.

All of these emerging factors seem to pervade the study of R&D in higher education. There is almost an underlying connecting theme that suggests(1) increased funding of applied research reflects the idea at the federal level that technology can indeed be used in increasing measures to solve the problems of a technological society and/or (2)t coordination of R&D funding to higher education will increasingly take the added form of regulations and compliance.

With the emphasis on government contracts, universities and colleges with federal contracts come under federal regulations requiring full access in the determination of compliance.[13] Commissioner Boyer suggests that only by assessing their role in federal R&D can universities and colleges assert whether their rights as autonomous institutions have been interfered with by the federal government.

In any event, according to Saunders, "the executive branch, through the research it sponsors, is likely to play a growing role in evaluating the effectiveness of current practices and programs in our colleges and universities."[14] Some refer to this as the "Enlightening"

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[13]U.S. Holds Up $1.5-Million Contract for Berkeley Lab: Layoffs Threatened," The Chronicle of Higher Education, (May 1978), p.44.

[14]Charles R. Saunders, Jr., "How to Keep the Government from Playing the Featured Role," Educational Record, (Winter, 1978), pp. 61-70.

phase of evaluation.

It seems that the clamor for more research and development funding is tied to the less apparent but more complex policies, emerging issues, and acts of intervention taken on behalf of the underlying federal and state interest in research and development in higher education.

From the perspective of the colleges and universities, as interventionists, a series of questions arise: Who has an interest in the university or college becoming a better competitor for R&D funds? How can institutions assess, clarify, and communicate their role in relation to the varied interests regarding research and development? Should or can the university or college re-tool for more applied and problem-oriented research? In what ways can the universities and colleges compete with large organizations for R&D funds? How many quality departments can an institution simultaneously maintain and yet secure a more diverse R&D package? What are the points of entry and leverage for increasing the R&D funds available for the humanities and the social science for institutions that emphasize these programs over programs in science/technology? How do institutions increase their level of performance for R&D funds when other institutions, known as 'good performers of contracts', are seeking to commit the government to sustained levels of funding or long-term contracts? How can institutions continue to do a greater share of their research for both industry and the federal government and avoid what is seen by some as intervention into the rights of institutions in such areas as research control and basic financial integrity?

From the state perspective on research and development, how can the state obtain a more equitable share of funds for state interests and for its colleges and universities? What are the other areas of equity that relate to the ability of state officials to draw talent to the state? Indeed, how can the state secure more diverse uses for its R&D, when the federal government as the major supporter of research and development is becoming an encourager of the mission-oriented work of federal agencies?

From the perspective of the federal government, who can best do research and development for the federal government- colleges and universities? Industry? Federally Funded Research Development Centers of colleges and universities? FFRDC's of private and or non-profit organizations ? Governmental agencies or labs? Others? How can reorganization and management (OMB) help the federal government to become a full partner in R&D funding? How can the government maintain equity and access (including governmental access) in R&D funding?

These questions all impinge in some way on the problems of R&D as related to the problems of R&D funding, the mechanism of allocations as related to federal/state problems of equity, and the problems of state/federal coordination as related to the ability of institutions of higher education to control their R&D programs. These questions present a challenge to institutions seeking to both intervene on their behalf relative to R&D funding and enter into a full partnership with state and federal interests relative to research and development funding.

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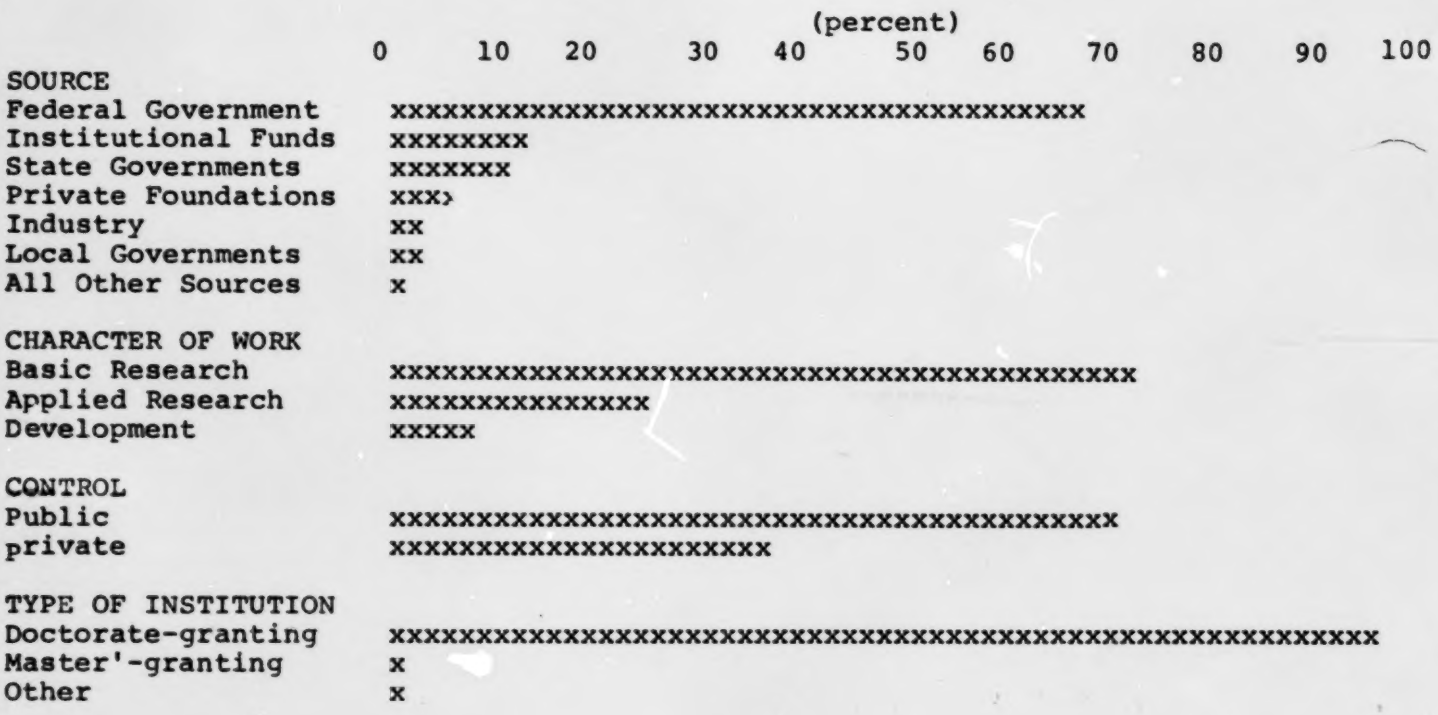
APPENDIX

R&D EXPENDITURES AT UNIVERSITIES AND

COLLEGES: FISCAL YEAR 1975 TOTAL: $3,393,000,000

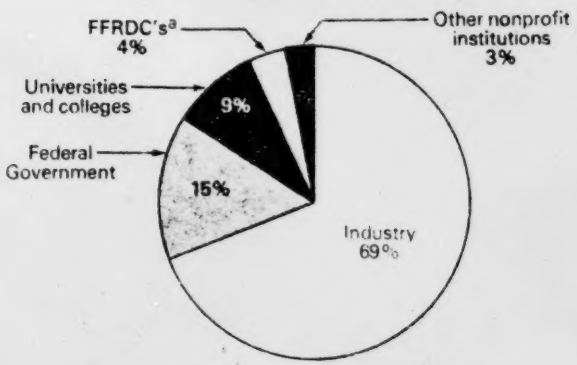


SOURCE: NATIONAL SCIENCE FOUNDATION

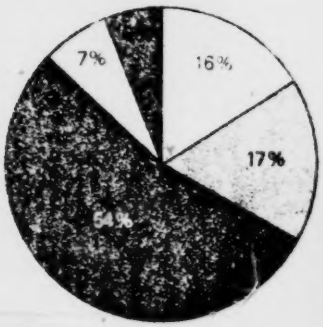
(Field Omitted)

Performance of U.S. R&D expenditures, by economic sector and character of work: FY 1975

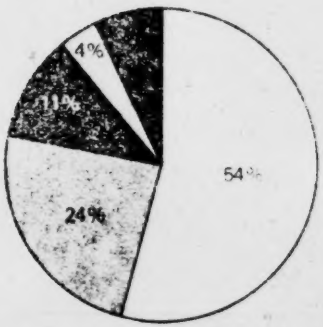
Total U.S. research and development: $35.2 billion



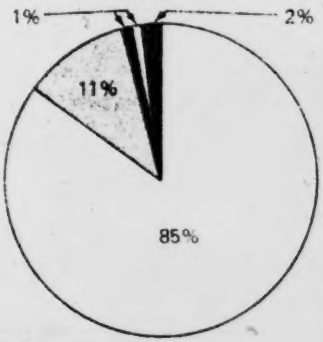
Basic research: $4.4 billion



Applied research: $8.3 billion



Development: $22.5 billion



[a] Federally funded Research and Development Centers.

SOURCE: National Science Foundation

SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, FISCAL YEARS 1973, 1974, AND 1975.

(MILLIONS OF DOLLARS)

ITEM	ACTUAL	ESTIMATES	
	1973	1974	1975
- Total Expenditure for Research, Development and R&D Plant	17,510.2	18,552.4	20,153.9*
Research & Development	16,872.1	17,658.3	19,135.3
R&D Plant	638.0	894.1	1,018.6
- Total Obligation for Research, Development and R&D Plant	17,595.6	18,715.1	20,709.6
Research & Development	16,821.2	17,743.2	19,597.1
Total Research	6,499.9	7,197.1	7,673.6
Basic	2,419.6	2,568.7	2,599.2
Applied	4,080.3	4,628.5	5,074.4
Development	10,321.3	10,546.1	11,923.5
R&D Plant	774.3	971.9	1,112.5

*The total U.S. research and development expenditure was $35.2 billion

Source: NSF

Note: -because of rounding, details may not add to totals

FEDERAL FUNDS FOR RESEARCH AND DEVELOPMENT
IN COLLEGES AND UNIVERSITIES (ALL AGENCIES)
FISCAL YEARS 1974 to 1976 (in thousands of dollars)

TOTAL

1974	1975	1976
3,191,687	3,380,924	3,381,000

ELEM-SEC EDUCATION

1974	1975	1976
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HIGHER EDUCATION

1974	1975	1976
1,483,098	1,611,116	1,611,100[1]

VOCATIONAL, TECHNICAL, CONT. EDUCATION

1974	1975	1976
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OTHER

1974	1975	1976
1,708,589	1,769,808	1,770,000

[1] NCES estimate

Source: National Center for Education Statistics